Chapter 5

Yangtze River Population of Finless Porpoises (*Neophocaena phocaenoides*)

Report of the Workshop to Develop a Conservation Action Plan for the Yangtze River Finless Porpoise, Ocean Park, Hong Kong, 16–18 September 1997

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Abstract

The population of finless porpoises (*Neophocaena phocaenoides*) that inhabits China's Yangtze River is unique. All other known populations of the species are distributed principally in marine waters. This population is also one of the few geographical populations of cetaceans (whales, dolphins, and porpoises) listed as Endangered in the *1996 IUCN Red List of Threatened Animals*. Chinese scientists report that Yangtze finless porpoises are rapidly declining and that, in response, officials within China wish to stock "semi-natural reserves" and other facilities with porpoises. This approach to conservation was adopted several years ago with the explicit objective of preventing the extinction of baiji (*Lipotes vexillifer*). Although the baiji rescue effort has been unsuccessful so far, it appears that the same approach is now being taken to conserve the finless porpoise, with no rigorous advance consideration of its appropriateness.

A workshop was convened at Ocean Park, Hong Kong, in September 1997 to review information on Yangtze River finless porpoises and develop recommendations concerning their conservation. Participants included experts from China, Japan, Hong Kong, Taiwan, the United States, and Canada. Planning and execution were done jointly by Ocean Park Conservation Foundation and the IUCN/SSC Cetacean Specialist Group.

Wang Ding, of the Wuhan Institute of Hydrobiology (WIH), summarized recent research and management activities in the upper reaches of the Yangtze. A population estimate of 2,700 porpoises was made, referring to the period 1978–91. More recent surveys provided indices pointing to a dramatic decline in abundance since then. Thirty-six finless porpoises have been removed from the Yangtze and placed in the Shishou semi-natural reserve since March 1990. Nine porpoises have been born in the reserve, including one that is known to have been conceived there. Losses, due mainly to escape and accidental killing, have resulted in a current population of five porpoises in the reserve. Two outstanding problems with the reserve were noted: (1) a barrier to prevent animals from escaping during the flood season has not been completed, and (2) fishing within the reserve continues to pose a threat to the porpoises and their food supply. Additional porpoises have been brought into captivity at the WIH, where two animals presently reside.

Zhou Kaiya, of Nanjing Normal University, summarized work on a life table and population dynamics of finless porpoises in Chinese waters, as well as recent survey work in the lower reaches of the Yangtze. Although some concerns were expressed about possible bias from the ways specimens were obtained, the life table analyses generally reinforce the conclusion from surveys that there is a serious conservation problem with finless porpoises, not only in the Yangtze River, but also in coastal marine waters. Surveys in 1990–92 suggested a total porpoise population of about 700 porpoises in a 421km segment of the lower reaches. Results of these surveys also support the hypothesis that porpoises occur in greater abundance and in larger groups in river reaches characterized by numerous bends and sandbars, relatively slow water flow, rich fish resources, and relatively little vessel traffic.

Threats to finless porpoises in the Yangtze River include incidental mortality from entanglement in passive fishing gear, electric fishing, collisions with powered vessels, and exposure to explosives used for harbor construction. Much of their habitat has been severely degraded, due to the damming of Yangtze tributaries and the intensive use of the river as a transportation corridor. The effects of pollution and reduced availability of prey species are not well documented, but they represent serious additional concerns. Numerous topics were formally discussed by the group before formulating conclusions and recommendations. The workshop's principal conclusions were:

1. The finless porpoise population in the Yangtze River is likely to continue declining unless serious efforts are made to protect the animals and their habitat (including prey resources).

2. The ultimate goal of conservation efforts must be to maintain a viable wild population of porpoises in the river, and any *ex-situ* conservation strategy (e.g. establishment of "semi-natural reserves," maintenance of porpoises in captivity) can only be justified if it contributes to that goal.
3. Even more important than creating new "natural reserves" or expanding existing ones is the need to educate people about, and strictly enforce, regulations concerning the use of destructive fishing gear or methods.
4. A deliberate, step-by-step approach should be taken in evaluating any proposal for *ex-situ* conservation of Yangtze finless porpoises. In the specific case of Shishou semi-natural reserve, it should be acknowledged that a porpoise "population" already exists there. Thus, an initial requirement is that all harmful fishing be eliminated and the barrier fence be completed to improve the safety and security of those five animals. A critical review of available information is needed to provide advice on the required size and composition of a founding stock of finless porpoises. Water quality and sediment in the reserve need to be rigorously evaluated and monitored on an ongoing basis. A program of studying the animals presently in the reserve should be initiated, including marking (e.g. freeze-branding) and a sampling regimen of some kind. These steps should be taken prior to any consideration of further captures to stock the Shishou reserve.
5. The Tongling facility is best used, for the present, as a rehabilitation center for sick or injured porpoises (and dolphins) rather than being stocked with additional deliberately caught animals.
6. Like the five animals already present in Shishou reserve, the two animals already in captivity at the WIH constitute a small existing captive "population." Strenuous efforts should be made to improve the quality of their environment and to advance knowledge by observing and experimenting with these porpoises. Collaboration in these endeavours with experts from Hong Kong, Japan, and elsewhere is highly desirable.
7. Among the types of additional research that are needed to support conservation efforts are: tracking and marking studies in the wild and possibly also inside the Shishou Reserve; site-specific studies in key areas to investigate aspects such as the nature of threats, local movements by groups or individuals, and habitat preferences; and studies of genetics and contaminant levels using tissues from salvaged carcasses or from biopsies (e.g. skin scrapings) from live animals.
8. A scientific presence should be established and maintained in and near the Xin Luo Natural Reserve for baiji, with at least two primary objectives: (1) to provide a means of evaluating the effectiveness of protective measures and (2) to obtain information that can be used to guide management decisions in the future (e.g. changes in the reserve boundaries).

Introduction

Chinese scientists have concluded from survey and other data that the finless porpoise (*Neophocaena phocaenoides*) population in the Yangtze River has been declining for at least several decades. The reasons for the decline are not entirely clear, but it is assumed that incidental take, pollution, vessel traffic, and habitat degradation have all contributed. This finless porpoise population was listed as Endangered in the *1996 IUCN Red List of Threatened Animals*. Also, Chinese authorities are in the process of upgrading the finless porpoise's status from the Second to the First Order of Protected Animals in China, which will mean that the species is given full protection under the law. A workshop was held at Ocean Park, Hong Kong, 16–18 September 1997, to begin development of a long-range conservation strategy for this endangered population.

T.A. Jefferson, co-director of the Ocean Park Conservation Foundation (OPCF) and the workshop convenor, welcomed participants and outlined the objectives and agenda. He dedicated the workshop to the memory of Steve Leatherwood, founding director of OPCF, who died in January 1997. Josephine Woo, co-director of OPCF, offered additional remarks concerning the foundation's ongoing commitment to cetacean conservation in Asia and expressed hope that the recommendations from this workshop would lead to significant progress in conserving Yangtze finless porpoises.

Three background documents were provided by Chinese participants (Wang Ding 1997; Zhou *et al.* 1997; Yang *et al.* 1997; see later). In addition, an English translation of Zhang *et al.* (1993) was kindly provided by Mientje Torey, and a partial bibliography of the Yangtze finless porpoise was prepared for the workshop by Jefferson.

R.R. Reeves, chairman of the IUCN/SSC Cetacean Specialist Group (CSG), summarized events leading up to the workshop. During discussions at the Asian River Dolphin Committee meeting in Bangladesh in February 1997 (Smith and Reeves 1997), it had been evident that Chinese authorities intended to capture more finless porpoises to stock the Shishou Semi-natural Reserve and the captive-maintenance facilities at the Wuhan Institute of Hydrobiology. The semi-natural reserve and the tanks at Wuhan were originally developed as part of a strategy to conserve the baiji (*Lipotes vexillifer*) (Perrin and Brownell 1989; Ellis *et al.* 1993; Kasuya 1997). The implicit assumption seems to have been that the *ex-situ* measures taken to prevent the baiji's extinction were also appropriate for the Yangtze River population of finless porpoises. Although porpoises remain much more abundant in the

Yangtze system than the sympatric baiji, they are thought to be experiencing a rapid decline (Zhang *et al.* 1993; Zhou *et al.* 1997; Wang Ding *et al.* 1997). In view of this situation, it was felt that a workshop was needed to explicitly address the question of whether further collections of finless porpoises were appropriate, either for translocation into semi-natural reserves or for long-term captive maintenance.

It was agreed that Jefferson would act as chairman of the workshop, B.D. Smith would act as rapporteur, and Reeves would take primary responsibility for drafting recommendations and writing the workshop report. The workshop agenda is attached as Appendix 1 and the list of participants as Appendix 2.

In addition to the primary financial and in-kind support provided by Ocean Park and OPCF, important contributions were made by the Chicago Zoological Society and the CSG. Hiedi Chan (OPCF) and Irene Wong and Josephine Woo (Ocean Park) facilitated many aspects of the workshop's planning and execution. Also, Mientje Torey and Isabel Beasley helped with logistics, and Mary Felley served as a translator for Wang Peilie.

Summary of oral presentations

Formal presentations were made by Wang Ding and Zhou Kaiya, based on background documents prepared for the workshop (Wang Ding *et al.* 1997; Yang *et al.* 1997; Zhou *et al.* 1997). The contents of these presentations are summarized below:

Population Status and Conservation of the Yangtze Finless Porpoise – Wang Ding

Surveys of baiji and finless porpoises from 1978 to 1991 resulted in an average estimate of 2,700 for the total population of finless porpoises in the Yangtze during this period (Zhang *et al.* 1993). Additional surveys were conducted in segments of the Yangtze from 1991 to 1996 (Wang Ding *et al.* 1997). Results of these surveys were interpreted to indicate a drastic decrease in numbers. For example, encounter rates in the middle reaches of the river declined from 0.14 to 0.07 porpoises/survey kilometer (km), and from 8.62 to 2.7 porpoises/survey day, between spring 1991 and spring 1992. Moreover, in spite of improved observation methods (i.e. more vessels and more observers), this trend continued in later years, with rates of 0.55 porpoises/survey km in spring 1994, 0.29 in spring 1995, and 0.12 in spring 1996, or 4.35, 3.69, and 2.13 porpoises/survey day, respectively, at the same one-year intervals. Although fewer data were available for the lower reaches, the "trend" there appeared similar. Taken at face value, these results confirm the impression held by Chinese scientists from several different institutions that porpoises are becoming much scarcer in parts of the Yangtze River than they were as recently as the 1970s and even the 1980s. No quantitative analysis of the survey data was conducted to assess the significance of apparent trends, however. Also, no attempt was made to provide a new estimate of absolute abundance from the 1991–96 survey data. Areas with particularly high densities of porpoises included: the section from the mouth of Poyang Lake to Balijiangkou, Sanjiangkou, Xintankou, Tianxinzhou, Luxikou, Chibi, Chenlingji, and Sunliangzhou. Also, animals were often present in Poyang and Dongting lakes.

The Shishou semi-natural reserve (see Figure 1), situated 360km upriver from Wuhan (250km by road), is a 21km long oxbow (see Perrin and Brownell 1989: their Appendix 9). It is connected with the main river during the five month summer flood season (approximately June–October) by a 100 to 150m wide channel. During the rest of the year, there is only a small amount of flow and

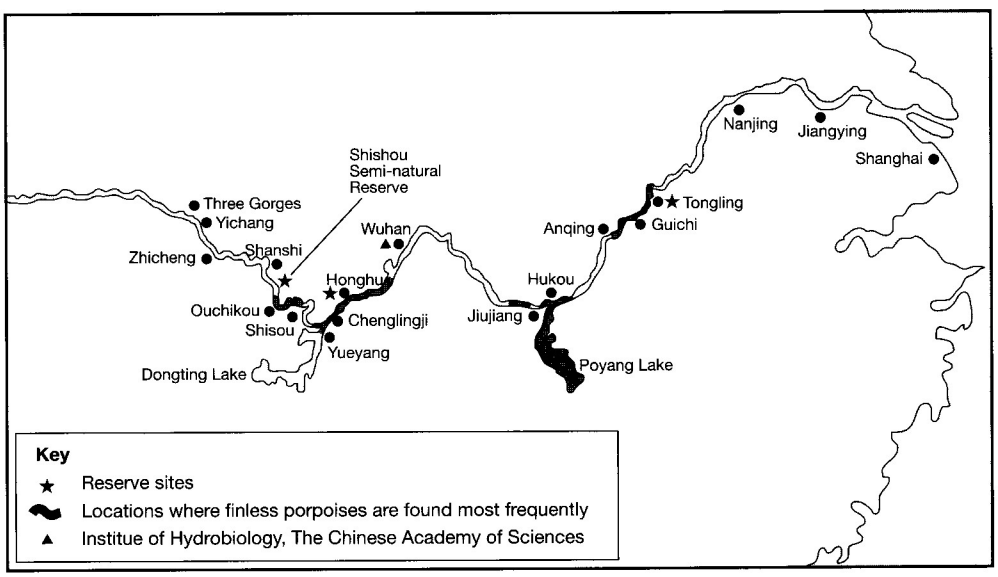

Figure 1. Areas of concentration of the Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*).

seepage into the river, and it is impossible for cetaceans to enter or leave the reserve. Between March 1990 and December 1996, a total of 36 finless porpoises (17 females, 19 males) were translocated into the Shishou reserve and nine porpoises were born there. Of the 45 animals, 11 died, 14 escaped into the Yangtze River during the 1996 flood season, and 15 were released because of concerns about fishing activity within the reserve. Of the 11 deaths, seven occurred accidentally during capture operations for radio-tagging in October 1993; two animals were killed by rolling hook longlines; one died from capture-related injuries within a few weeks after being brought to the reserve; and one was a premature birth caused by capture operations. Thus, five animals, of uncertain age and sex, are currently living in the reserve. At least one of the porpoises born in the reserve was conceived there, but most, if not all, of the others were conceived prior to capture.

Assessments of fish production in the reserve have consistently shown that there is adequate food to support breeding colonies of both baiji and finless porpoises. However, there are two outstanding difficulties. First, construction of a permanent artificial barrier at the mouth of the reserve has not yet been completed. This barrier is needed to prevent escape of cetaceans during the flood season. Until it is constructed, no additional porpoises (or baiji) should be introduced. Second, fishing activity in the reserve needs to be stopped. At least two of the finless porpoises that died in the reserve were killed by rolling-hook longlines. Also, the reason given for releasing 15 porpoises back into the Yangtze in spring 1997 was that they were competing with fishermen. Thus, local people have clearly not accepted the idea that cetaceans should have first priority in using the reserve's resources. About 600 people continue to depend on fishing in the reserve for their livelihood.

Wang Ding and his colleagues continue to believe that the potential problem of competition between finless porpoises and baiji (see Perrin and Brownell 1989; Ridgway *et al.* 1989; Leatherwood and Reeves 1994; Reeves and Leatherwood 1995) is unimportant and should not impede ongoing efforts to stock the reserve with both species.

Wang Ding *et al.* (1997) conclude that the degradation of the Yangtze River is bound to continue and therefore that the best hope for saving the Yangtze finless porpoise population from extinction is by establishing *ex-situ* breeding colonies. The Shishou semi-natural reserve is proposed as a model for the maintenance and breeding of porpoises. These authors also suggest that "natural reserves" be established for protecting porpoises in areas of the river known to be frequented year-round. A pair of porpoises (an adult male and a juvenile female) are being kept in a tank at Wuhan for study of reproductive behavior and physiology. A third animal (juvenile female) was released after it was noted that she could not feed normally.

Life Table and Population Dynamics of Finless Porpoises in Chinese Waters – Zhou Kaiya

Static life tables were constructed for three populations of finless porpoises: Yangtze River, Yellow Sea, and South China Sea. Specimen totals used in the analyses were 107, 122, and 45, respectively. Most of the specimens either stranded or were salvaged after being taken incidentally in fishing gear. Age estimates for these specimens were derived in four ways, either: (1) by counting dentinal growth layer groups, (2) from Zhang (1992), (3) by inference from porpoises of similar body length and weight whose teeth had been sectioned for growth-layer counting, or (4) by inference from age-length curves (Gao and Zhou 1993). The porpoise specimens were grouped into age classes at two year intervals. Survivorship, mortality, and death-rate curves were derived from the life tables, and intrinsic rates of increase were calculated for the three populations.

The survivorship curves were L-shaped, indicating poor survival in the 0–2 and 2–4 age classes. Deaths peaked in the 0–2 age class for all three populations, and the peak extended into the 2–4 age class for the Yellow Sea and South China Sea populations. The mortality rate of the Yangtze River population was lower than those of the other two populations for most age classes, with the notable exception of the 8–10 age class.

For calculating intrinsic rates of increase, it was assumed that the maximum reproductive rate (m_x) was 0.7. It was further assumed that m_x was 0 for the first two age classes (0–2 year and 2–4 year), and the third as well (4–6 yr) in the case of the Yangtze River population, in which females do not attain sexual maturity until six years of age (Gao and Zhou 1993). The m_x for the 4–6 age class in the Yellow Sea and South China Sea populations was assumed to be 0.35 because female sexual maturity is reportedly attained at an average age of five years in those populations (Gao and Zhou 1993). Females as old as 23 years were assumed to be reproductively active, based on Shirakihara *et al.* (1993). However, since all animals older than 16 years were assigned to a single age class, presumably some of them would be reproductively senescent, so the m_x for this age class was assumed to be 0.35. Thus, only the animals between 6 and 16 years old were assumed to have an m_x of 0.70.

For all three populations, the net reproductive rate and finite rate of increase were less than 1, and the instantaneous rate of increase was less than 0. This analysis therefore indicates that all three populations are declining. Although the authors (Yang *et al.* 1997) acknowledge that a dynamic, rather than static, life table would have provided more reliable results, and that their sample sizes were relatively small (especially for the South China Sea population, for which n=45), they consider this exercise the best that could be done with the data available. During the discussion, it was noted that the samples may be biased because of the ways in which the specimens were obtained. Nevertheless, the life table analyses reinforce the conclusion from surveys

that there is a serious conservation problem with finless porpoises, not only in the Yangtze River but in Chinese marine coastal waters as well.

Abundance and Distribution of Yangtze Finless Porpoises in the Nanjing-Hukou Section of the Lower Reaches of the Yangtze River – Zhou Kaiya

No verbal presentation was made at the workshop; an earlier version of the manuscript had been presented at the meeting of the Asian River Dolphin Committee in February. The main results are summarized here from the written document tabled in Hong Kong.

Six surveys of the Yangtze River between Nanjing and Hukou were organized and conducted by staff of Nanjing Normal University between 1989 and 1992. The field and analytical methods were essentially the same as those reported by Zhang *et al.* (1993) and Wang Ding *et al.* (1997). Estimates of absolute abundance from the four surveys with complete coverage of the 421km segment of river averaged 697 ± 47 individual porpoises. A comparison of results from this study and that by Zhang *et al.* (1993) suggests a decline in average porpoise density and abundance between the period December 1984–June 1991 and the period March 1990–March 1992. The 1990–92 survey results support the hypothesis that porpoises occur in greater abundance and in larger groups in river reaches characterized by numerous bends and sandbars, relatively slow flow, rich fish resources, and relatively little vessel traffic. Zhang *et al.*'s (1993) conclusion that finless porpoises in the lower Yangtze River make annual long-distance migrations to the Yellow Sea in summer and fall is not supported. Rather, Zhou *et al.* (1997) suggest that the increased size of groups seen in the Yangtze River during winter and spring (December–April) is best explained by the more clumped distribution of porpoises in these seasons.

Summary of discussion of agenda items

In this section highlights of the group discussion under each agenda item are summarized. For additional details, the reader is referred to Smith and Reeves (1997) as well as the cited literature.

Background on Yangtze finless porpoises

What is known about Yangtze finless porpoise life history (reproduction, feeding, etc.)?

Attention was called to the question of whether the supposed difference in average age at sexual maturity in Yangtze females (six years) compared to females in other populations (four years) (Yang *et al.* 1997, as summarized above) is real, or an artifact caused by sampling or methodological inconsistencies. An exchange of sectioned teeth or slides between laboratories might be appropriate for evaluating and reconciling any differences in methods or interpretations. According to Wang Ding (pers. comm., see Zhang 1992), Yangtze porpoises normally reach sexual maturity at four years of age, so in his view, they do not differ in this respect from the porpoises in Chinese marine waters.

The subject of feeding behavior and food preferences was discussed mainly in the context of how it might relate to the role of prey depletion as a causative factor in the finless porpoise's decline in the Yangtze River. The prevailing view is that finless porpoises generally prey on smaller organisms than those taken by baiji. Some overlap in diet is recognized, with respect to both the sizes and species of organisms taken. Assuming that the depletion of fish resources in the Yangtze has followed the typical pattern, with the larger species and the larger individuals within species affected earliest and most severely, the impact on baiji would be expected to be more immediate than that on finless porpoises. An implicit assumption is that finless porpoises have been better able to respond to the effects of overfishing. However, it was agreed that too little is known about the energy budgets and food habits of either species to reach definitive conclusions. It was suggested that food-preference studies using the porpoises currently in captivity might be useful.

Is there more than one Yangtze finless porpoise stock?

This question was divided into two: first, are the Yangtze River porpoises reproductively isolated from those in the Yellow Sea? Second, is there more than one porpoise population within the Yangtze system?

While it was acknowledged that some evidence can be interpreted as suggesting seasonal movements by Yangtze animals into the estuary (see Zhang *et al.* 1993), the balance of opinion is that the porpoises in the Yangtze are reproductively isolated and therefore constitute a discrete population. A clear definition of the boundary between it and the marine population, however, must await further research.

Although there are high-density zones within the river, separated by areas in which porpoises are rarely seen, no actual gaps in distribution have been identified. The question of subpopulations within the river must remain open for the present.

What are the main threats to the Yangtze finless porpoise population?

The group had considerable difficulty addressing this question. Although porpoises were often killed deliberately for oil and meat in the past (e.g. Liu 1991), particularly perhaps during the "Great Leap Forward" beginning in autumn 1958 (Zhou and Zhang 1991:32–33), they are said to have been "well protected" since the 1980s (Liu 1991). In

any event, no evidence is available to suggest that direct exploitation is occurring on a significant scale at present.

Incidental mortality certainly occurs in passive fishing gear such as rolling hook longlines (some of which are illegal in the Yangtze) and encircling gillnets (Zhou and Wang 1994). Electric fishing, a practice that has become widespread in the Yangtze system during the past ten years, even though it is illegal, could be a major cause of porpoise mortality (and also damage their prey resources).

Collisions with powered vessels and deaths from explosives used for harbor construction are among the documented sources of mortality for the baiji (Zhou and Zhang 1991), and it was generally agreed that they probably affect finless porpoises as well.

The Yangtze River has been severely degraded as habitat for cetaceans and other wildlife. Some 1,300 small lake systems that were once connected to the Yangtze have been cut off by dams, and the Gezhouba Dam interrupts the natural flow in the mainstem. Besides affecting the sediment budget and hydrology of the river, such damming blocks fish (and porpoise) movements and probably causes a net decrease in fish production in the river. The amount of habitat suitable for finless porpoises to forage, rest, and carry on other vital activities has undoubtedly diminished, and this process is continuing unabated. Vessel traffic is rapidly increasing, and it is reasonable to suppose that porpoises are experiencing disturbance and, perhaps, physical damage from exposure to artificial noise. The potential for serious effects from chronic exposure to underwater noise cannot be dismissed, even though documentation is lacking.

Considerable discussion was devoted to the subject of pollution. Although several publications have documented levels of organochlorines and heavy metals in the tissue of finless porpoises in Chinese waters (e.g. Zhou K. *et al.* 1994; Zhou R. *et al.* 1993a, 1993b; Zhang H. *et al.* 1993, 1995, 1996), nothing exceptional has been identified that might help explain the Yangtze population's precipitous decline. Nevertheless, the same caution applies here as stated above in reference to noise: the absence of documentation cannot be taken to mean that serious health effects are not occurring.

Is the finless porpoise less vulnerable to bycatch than the baiji?

This question was raised initially at the Asian River Dolphin Committee meeting in the context of trying to explain why the baiji has declined to a much lower level of abundance than the Yangtze finless porpoise. If the finless porpoise is less vulnerable to bycatch, then it might be better able than the baiji to survive in the wild, without requiring *ex-situ* conservation measures to prevent its extinction.

In general, Wang Ding and Zhou Kaiya believe that baiji are more susceptible to entanglement in rolling hook longlines, while finless porpoises are at least as susceptible as baiji to capture in gillnets. Active gillnets used in shallow nearshore waters represent a serious threat to finless porpoises, which show a strong preference for such areas.

It is impossible to make a proper comparison of the two species' vulnerability for several reasons. Until recently, and perhaps still, the probability that porpoise carcasses will be reported is much lower than is the case for baiji carcasses. This is, in part, because the baiji is held in much higher esteem by fishermen and the general public (regarded as a "national treasure"), while the smaller, less conspicuous finless porpoise has no special status. Reporting and carcass salvage are not carried out on a systematic basis, so it is not possible to relate the frequency of documented mortality to the amount of effort made to obtain such information. Unless effort can somehow be standardized, any comparison will remain questionable.

Is there evidence that the Yangtze River mainstem can no longer support finless porpoises?

If the Yangtze finless porpoise population has been declining, as indicated by survey results and life table analyses (see above), then the ability of the river to continue to support this species is certainly in doubt. Human use of the river and its resources is expected to intensify for many decades into the future. Considering that present use is unsustainable, the porpoise population will probably continue to decline. Nevertheless, it is important to recognize that animals live-captured in recent years have been judged to be in good health and condition, and the porpoise population's reproductive output is not known to have declined. It is therefore appropriate to vigorously pursue measures to protect the porpoises from direct harm (e.g. incidental capture, vessel strikes, exposure to explosives, etc.), maintain as many natural qualities of the ecosystem as possible, and investigate factors causing the species' decline. While it may be true that substantial portions of the population's historic range are no longer suitable, there is no reason to abandon the hope of arresting the decline in at least a few carefully-selected areas.

How can we determine if there is competition between finless porpoises and baiji?

Two points were made during the brief discussion of this question. First, in spite of the fact that baiji generally eat larger fish than finless porpoises, competition could occur if both were eating different age classes of the same species. In other words, heavy predation by finless porpoises on the younger age classes of a given species could reduce the availability of larger individuals of that species to baiji. Second, Jefferson noted the almost completely allopatric distribution of finless porpoises and Indo-Pacific hump-backed dolphins (*Sousa chinensis*) in Hong Kong waters. Even though these two species might be considered

sympatric on a regional scale, and indeed they are seen occasionally in the same areas, competitive exclusion is a reasonable hypothesis for explaining their allopatric distribution at a local scale. In the case of baiji and Yangtze finless porpoises, competition may operate in a subtle way and thus be difficult to detect and describe.

If this research problem is ever to be addressed empirically, it will require that animals in the reserve be captured regularly, or at least handled (possibly after training) to assess their health condition. But this assumes that baiji will be caught and introduced to the reserve alongside finless porpoises, and that repeated capture and handling within the reserve could be done without jeopardizing the animals' survival. Such a scenario is very unlikely in the foreseeable future.

The potential role of semi-natural reserves

Is the Shishou Reserve currently a safer place for individual porpoises than the Yangtze mainstem? What about Tongling Reserve?

The basic design and conditions of Shishou Reserve were outlined by the Baiji Research Group in 1986 (Perrin and Brownell 1989: their Appendix 9). The concrete posts intended to support the chain-link fence across the mouth of Shishou Reserve are in place, but the fence is not yet available. Thus, at the present time, movement by cetaceans into and out of the reserve is possible for about five months each year. Until fencing is completed, the reserve cannot be regarded as a secure environment for long-term maintenance of either baiji or finless porpoises.

A second major problem is that the fishing families living on the banks of the reserve continue to depend on the fish stocks within the reserve for their livelihood. Thus, cetaceans in the reserve are vulnerable to bycatch in fishing gear, and they may well be competing with humans for food resources. Illegal fishing methods have been used within the reserve in recent years: at least two finless porpoises were killed by rolling hooks, including as recently as May 1992 (Wang Ding *et al.* 1997). Until some arrangement has been made to substantially reduce human pressure on the reserve's biological resources, and to guarantee the safety of cetaceans from direct harm by fishing gear, it cannot be considered safer for individual porpoises than the Yangtze mainstem.

On the positive side, vessel traffic in the reserve is minimal, with only one or two ferries operating. Two motorboats are available for use by the reserve's staff of 24. Presumably, the presence of the staff deters at least some of the illegal fishing that would take place (e.g. with rolling hooks or electricity) in their absence. Pollution levels in the reserve are reportedly no worse than in the Yangtze despite the fact that the only significant water input during much of the year is runoff from adjacent rice paddies. The apparent exceptions to this are that sulfide and coliform bacteria levels are anomalously high (Zhang *et al.* 1995), suggesting inadequate flushing.

A major obstacle to getting the fence completed, the fishing families relocated, and the reserve properly protected from illegal fishing is that the finless porpoise does not have nearly the same revered status as the baiji. This difference in perceived value means that local people are less concerned about harming the porpoises and that officials are less prepared to invest resources in development of the reserve than they would be if it were stocked with baiji. Some change can be expected once the finless porpoise is upgraded to a First Order protected animal. However, entrenched views, based on centuries of folklore and tradition (e.g. see Zhou and Zhang 1991; Wang Ding 1993), will only be changed through increased public education and awareness. There may be a role here for the international community, but, until this workshop, no outside financial investment in conservation efforts targeted explicitly at the Yangtze finless porpoise had been made.

Wang Ding pointed out that Three Gorges Dam is expected to reduce the extremes of flow in the middle reaches of the Yangtze. His expectation is that high flows will be lower and low flows higher once the dam is functioning, with the net effect that "escape" of animals back into the Yangtze will be less likely. Even if this "beneficial" effect of the dam were to occur, however, the artificial barrier would still be necessary. Also, the major anticipated change in flow regime, caused by Three Gorges Dam, could have offsetting negative effects, such as decreased flushing of the oxbow, leading to increased levels of organic and inorganic pollutants in the reserve. It is important to emphasize that as long as human communities live along the shores of the reserve, there will be a danger of point-source pollution within what is a largely lentic system for much of the year.

Tongling Reserve presents a quite different situation from that at Shishou. The scale is much smaller and the conditions much less natural (see Perrin and Brownell 1989: their Appendix 8). Fish production is inadequate to support cetaceans, so there is no fishing in Tongling Reserve. Much less investment has been made in development of Tongling Reserve, and it was generally agreed that, without considerable further assessment of water quality there, as well as completion of the infrastructure outlined by Zhou Kaiya in 1986 (Perrin and Brownell, as above), this reserve cannot be considered safer than the Yangtze River for finless porpoises.

Should the Shishou Reserve be a single-species reserve? If so, for which species?

Consensus was not reached on how this question should be answered. Those who considered the baiji translocation

initiative to be a failed approach that should be abandoned, took the position that Shishou was, if anything, a de facto reserve for finless porpoises already. Those who believed that efforts to collect baiji should continue supported the idea of stocking the reserve with both species.

Should finless porpoises be placed in the reserve at Tongling?
Most of the discussion of this question centered on use of the concrete tank, rather than the "semi-natural" reserve, at Tongling. A large investment has been made in the facilities and trained staff at Tongling. There was general agreement that the most suitable use of the Tongling establishment would be as a rehabilitation center for sick or injured cetaceans.

If live-captures are required, what techniques should be used?
Wang Ding summarized the technique used in the past to capture finless porpoises (and baiji) in the Yangtze River. Areas with slow current and shallow water are preferred as capture sites. Six small fishing boats (maximum ground speed approximately 5km/hr, travelling against the current) are used to trap the animals against the shore, using a specially-made large-mesh net. A smaller-mesh net is used once the animals are well herded inside the first net. Team members often have to enter the water to stop the animals entangling. Of 36 finless porpoises collected for the Shishou facilities since 1990, none have been killed outright, but one died later from injuries sustained during the capture operations (Wang Ding *et al.* 1997).

R. Wells compared the technique initially described by Wang Ding with that used routinely to capture, study, and release bottlenose dolphins (*Tursiops truncatus*) near Sarasota, Florida, USA. Wells and associates use their own adaptation of the seine-net technique described and illustrated by Asper (1975; also see Wells 1991). Areas with little current and shallow water are preferred. Depths at the capture site in Florida are often about 1.5m, in contrast to 4m or deeper in the Yangtze. In Florida, the animals are captured in the open without the benefit of a shoreline, but a major difference is that fast speedboats are used to corral the dolphins. Optimally, as many as ten boats and 30–50 people are used in the capture effort. The goal, in order to maximize safety for the animals, is to capture fewer than five individual dolphins at a time.

The technique used in the Yangtze was judged adequate for capturing finless porpoises. It was stressed, however, that at least one and preferably two faster boats would make the operations more efficient and safer for both the animals and the people involved.

The group also wished to emphasize the importance of having a protocol for collecting animals of particular age and sex classes. This protocol, which should be prepared in advance of further capture attempts, would need to be developed on the basis of a plan for achieving explicit demographic and other goals for the captive population such as re-creating natural social groupings (e.g. see Ralls 1989).

Should captive breeding and artificial insemination play a role?
The possibility that captive breeding and artificial insemination will need to play a role in the conservation of Yangtze finless porpoises cannot be discounted. However, the record, to date, of using captive porpoises (within China) to improve knowledge about breeding requirements and to develop ways of applying new technologies in their propagation is not promising. While several births have been reported in the Shishou semi-natural reserve since 1990 (Wang Ding *et al.* 1997), nothing seems to have been learned from these events about the animals' reproductive behavior and biology. Before considering the collection of additional animals to stock reserves and artificial environments, it is important to establish research protocols and husbandry programs with the animals that are already available in the reserve and holding pool.

A partial list of tasks that can or should be completed with the available group of animals, starting immediately, might include:

1. The animals in the reserve need to be marked in some way so that they can be identified individually through time. The feasibility of freeze-branding should be tested with these animals.
2. Tooth extraction is the only means of obtaining reliable age estimates for porpoises older than about 4 years (the age-length relationship is not necessarily reliable for adults). (Any tooth extraction should only be attempted when a person with experience in the procedure is involved.)
3. Body weights should be monitored on a regular basis.
4. Ultrasound examinations can provide valuable information on blubber thickness (an index of condition), fetal development, and stage of maturation.
5. Blood profiles are essential for monitoring health and reproductive cycles.
6. Blowhole swabs provide opportunities to evaluate and monitor microbial fauna.
7. Small skin scrapings or blood can be used for genetic analyses.

Should public viewing and "ecotourism" be allowed or encouraged at the reserves(s)?

An Earthwatch program was conducted in the Shishou reserve for two years but has been discontinued. There is a small reserve for Pere David's deer (*Elaphurus davidianus*) nearby which provides a supplementary tourist attraction.

Discussion of this question was brief and inconclusive.

Protection in the natural habitat

What techniques should be used for population assessment and stock structure studies?

Wang Ding summarized plans for a large-scale, system-wide survey of baiji and finless porpoises in the Yangtze, scheduled for November 1997. This survey was intended to involve numerous vessels and hundreds of people, with the intention of achieving complete, non-overlapping coverage of the entire range of both species in one week. The methods of data collection and analysis described by Zhang *et al.* (1993) were to be used.

It was generally agreed that future monitoring surveys for population assessment should emphasize standardization of procedures. This proviso applies not only to the design and methods of observation, but also to the timing of the surveys. Time should be judged by water level rather than date. The goal should probably be to obtain index values rather than estimates of absolute abundance, although this would depend on the management objectives being served by a given survey program. If the intention is to obtain an estimate of the actual number of porpoises present in the river, it is essential to use a sampling technique, such as line or strip transect, and to achieve representative coverage of the entire width of the channel, even though porpoises have a strong tendency to inhabit waters within several hundred meters of shore (Zhang *et al.* 1993). If, on the other hand, an index is sought, two boats travelling in tandem on opposite sides of the river may be adequate.

Studies of stock structure can be pursued using several different approaches. Genetic and other studies (e.g. of contaminant or parasite loads, morphometrics, etc.) can take advantage of stranded animals, animals obtained from fishermen (bycatch), samples already in storage, and skin scrapings or blood from captive porpoises. Movements by individual porpoises can be tracked through freeze-branding (after testing with captive animals or animals in the semi-natural reserve) or radio telemetry. Although there is no reason to expect there to be local stocks of porpoises within the Yangtze system, a comprehensive recovery or conservation plan requires that the degree of mixing among areas be well understood.

Can we define and designate critical habitat for finless porpoises in the Yangtze?

Finless porpoises, like other river cetaceans (see Zhou and Li 1989; Hua *et al.* 1989; Smith 1993), tend to congregate in areas of interrupted flow where counter-current eddies provide hydraulic refuge and good foraging opportunities. In this respect, their habitat preferences can be said to be broadly similar to those of baiji. Bars or sandbanks, sharp bends, and confluences often create suitable conditions for cetaceans. As mentioned previously, porpoises occur mainly in shallow water near shore (Zhang *et al.* 1993). The mouths of Poyang and Dongting lakes are recognized as areas where porpoise density is consistently high, with the animals moving freely into and out of the lakes (Figure 1). Such tributaries are also centers of fishing activity and vessel traffic. Areas with relatively high numbers of survey observations are easy to identify (e.g. see previous summary of Wang Ding *et al.* 1997), but more needs to be known about seasonal movements, individual home ranges, and turnover rates at specific sites before "critical" habitat can be defined and designated. One way of answering this need might be by initiating long-term site-specific studies in several of the areas shown by survey data to be suitable for year-round observation.

Should additional radio-tracking be undertaken?

Much useful information can be obtained from radio tracking. Limited experience with vest-mounted tags suggests that such tracking can be done safely and efficiently (Zhang *et al.* 1996). Conventional radio tags are good for ranges only up to about 50 km. For tracking over greater distances, a satellite link will be necessary. There is a need for more development and testing before a satellite tag that is appropriately small and unintrusive can be considered for use on these small finless porpoises.

There was no disagreement about the desirability of having more telemetry work done with Yangtze finless porpoises. It was emphasized, however, that the danger of injuring or killing animals by accident is ever-present. Thus, any radio-tracking activity needs to be carefully justified and well planned. Much progress has been made in recent years by American, European, and Japanese scientists in developing and field-testing telemetry devices for small cetaceans, including harbor porpoises (*Phocoena phocoena*), which are only somewhat larger than finless porpoises. Incorporation of this international expertise into any tagging program in the Yangtze could be expected to improve efficiency and reduce the risks to animals.

How can public awareness of the finless porpoise best be increased?

The Yangtze finless porpoise's local name means "river pig," and it is associated in traditional mythology with ugliness, cruelty, and foolishness (Wang Ding 1993). Unlike the baiji, it receives no benefit from existing cultural bias. On the contrary, transforming the porpoise into a national treasure will be an enormous challenge to scientists and conservationists. Its upgrading to a First Order protected animal should improve the porpoise's status, but the Yangtze population's global significance as the only known freshwater population of its species needs to be publicized at every opportunity through every available forum. This must be done in the face of widespread disillusionment caused by the failed campaign to save the baiji. It is hoped that the baiji's rapid decline, apparently irreversible at this stage, will be seen as a lesson and a warning. Having done

too little, too late, for the baiji, immediate action must be taken to slow, and reverse, the degradation of the Yangtze ecosystem before yet another member of its unique fauna becomes extinct. It is always important to emphasize that cetaceans are not fish. The usual "quick fix" of using hatchery programs to replace, maintain, or enhance wild stocks does not apply to cetaceans. Only genuine protection of the animals and respect for their needs can ensure a viable population in the long term.

How can existing measures to protect baiji be modified to also benefit finless porpoises?

The need to enforce regulations against destructive and unsustainable fishing practices is obvious. If the Yangtze's fish resources have been damaged and destroyed, despite the calls to safeguard them on behalf of human communities, and recently to prevent the baiji's extinction, it seems unlikely that calls to protect them for the benefit of finless porpoises will have much effect. The same might be said about calls to reduce pollution and traffic congestion in the river.

Most of the discussion centered on the Xin Luo Natural Reserve for baiji, a 135km segment of the Yangtze centered at Honghu City and stretching upriver to a point about 20km below the mouth of Dongting Lake. A staff of 15–17 people, equipped with a motorboat and based in Honghu City, is entrusted with providing strict protection for baiji and enforcing fishing regulations. One way in which the fishing regulations differ inside and outside the reserve is that rolling-hook longlines are prohibited within the reserve, while outside it, only certain sizes of hooks on longlines are banned.

Wang Ding urged that the boundary of Xin Luo Reserve be extended upstream to encompass the mouth of Dongting Lake, an area long recognized as having a high density of finless porpoises. He also urged that the official mandate of the reserve be expanded to include the finless porpoise under its mantle of protection. Other participants were supportive of these gestures, in principle. However, they were very concerned about two aspects of the proposal.

First, it was unclear whether the basis for designating this particular area as a finless porpoise reserve was grounded in scientific understanding of the survival needs of the animals, or instead in administrative convenience. In other words, is there any evidence that the type of protection afforded by the reserve, if extended to include the mouth of Dongting Lake, would actually contribute to the conservation of finless porpoises? Second, there was considerable doubt as to whether enforcement of regulations had been effective in protecting the baiji within the existing reserve boundaries. Without a mechanism for assessing and monitoring effectiveness, an increase in size and an expansion of the mandate of a protected area would seem at best pointless and at worst counter-productive.

Both of these concerns might be addressed by a scientific presence in the region. A long-term site-specific study at the mouth of Dongting Lake, for example, would provide a better understanding of what features of this area are important to finless porpoises. This, in turn, would make officials better able to judge what types of protective measures are needed.

What realistic measures can be taken to protect finless porpoises in the Yangtze?

This question had been addressed, at least implicitly, in the previous discussions.

Conclusions and recommendations

General conclusions:

Chinese scientists have concluded that conditions in the Yangtze River will continue to deteriorate in the foreseeable future and that the decline in the finless porpoise population will therefore continue. The establishment of one or more captive populations in semi-natural reserves obviously represents one possible conservation strategy, following the same logic that was outlined for the baiji in the Wuhan workshop report in 1986 (Perrin and Brownell 1989). The situation of the finless porpoise, however, differs from that of the baiji in several respects. First, there are more finless porpoises in the Yangtze River today than there were baiji in 1986 (Liu 1991; Liu *et al.* 1997). Second, there is already a relatively long history of holding finless porpoises in captivity, especially in Japan but also in China. Third, five finless porpoises are already being kept in the Shishou Semi-natural Reserve (age and sex uncertain) and two (one adult male and one juvenile female) in a tank at the Wuhan Institute of Hydrobiology. In other words, a small captive population of Yangtze finless porpoises already exists. Finally, experience has shown that finless porpoises are much easier to capture than baiji, and that they can be handled and trained.

As a working principle, the group wished to emphasize that the ultimate goal must always be to maintain a viable wild population of porpoises in the Yangtze River and that all measures endorsed or recommended here are intended to serve that goal. Moreover, it is necessary to bear in mind at all times when considering *ex-situ* approaches that any removal of animals from the wild has a negative effect on the wild population. This "cost" must be weighed against the potential benefit to the wild population that might eventually be realized through reintroduction or restocking. The long-term maintenance of a captive population in either a semi-natural reserve or an aquarium tank does not, by itself, constitute a conservation strategy. It is only justified, in conservation terms, if it contributes to the maintenance of the wild population at some future time.

Conservation of finless porpoises in the wild (*in situ*):

1. Even more important than creating new reserves or expanding existing reserves is the need to educate people about, and strictly enforce, regulations restricting the use of destructive fishing gear within the currently protected area for baiji. The finless porpoise should be included, along with the baiji, as an intended beneficiary of any protected area of the Yangtze River. Effectiveness should be monitored and evaluated by regular surveys of illegal fishing and other harmful human activities.
2. Together with efforts to make the existing baiji reserve safe for cetaceans, the desirability and feasibility of extending protective measures to additional areas explicitly for the benefit of finless porpoises should be explored.
3. There is a need for long-term monitoring of population trends throughout the river, and the current baiji reserve should be a focal area for such monitoring. The most critical feature of the monitoring program is that the methodology and survey procedures are standardized and constant. A sighting survey, using two boats travelling along opposite sides of the river, within a specified distance from shore, might be suitable for sampling and monitoring trends in abundance, calf production, etc. Regardless of the financial and logistical constraints, however, the methodology should conform to a standard sampling technique, such as line or strip transect, that allows rigorous estimation of numbers or evaluation of trends.
4. Tracking and marking studies are a high priority because of the potential for learning about individual movement patterns, home ranges, site fidelity, seasonal movements, social affiliations, etc. If possible, three to five individuals should be radio-tagged, with only large and healthy adults selected for tagging. The attachment method should incorporate a timed-release mechanism. A preferred tagging locality would be somewhere inside an existing or proposed reserve (e.g. Xin Lou Baiji Reserve).
5. Whenever animals are captured, a full suite of morphometric data and biological samples should be collected before release. Capture should only be undertaken when trained veterinary personnel are present.
6. At least one site-specific study of the behavior and distribution of the porpoises and the nature of local threats to these animals should be initiated. Ideal locations for such studies would be areas within existing or proposed reserves, with the studies preferably involving one or more graduate students based in the area.
7. Genetic and morphometric studies would be useful for determining broad-scale exchange between the middle and lower reaches of the Yangtze River and between the riverine and marine populations.
8. Studies of contaminant levels in the tissues of finless porpoises and their prey are important and should be encouraged.

Conservation of finless porpoises in semi-natural reserves (*ex situ*):

The security fence to prevent escape from the Shishou Semi-natural Reserve is not complete; harmful human activities (e.g. fishing in ways known to result in incidental mortality of cetaceans) continue inside the Reserve; and questions remain concerning the quality of the water in the Reserve. Thus, at present, the Shishou Semi-Natural Reserve is not a safe environment for either baiji or finless porpoises. In view of the scarcity of baiji and the difficulty of finding and collecting them, efforts to collect and translocate this species into the reserve should be suspended. Even if conditions in the Reserve were improved, e.g. by completing the security fence and eliminating dangerous fishing practices inside the Reserve boundaries, it would be very difficult, perhaps impossible, to find and collect a sufficient number of baiji to establish a viable captive population (following the guidelines provided by Ralls 1989).

In combination, the circumstances described above can be interpreted to mean that a deliberate, step-wise approach should be taken in evaluating any proposal for using *ex-situ* management to conserve the Yangtze finless porpoise. The group agreed that the following steps should be taken, in the stated order, before any decision is made concerning the further collection of Yangtze finless porpoises.

1. Conditions in the Shishou Semi-natural Reserve must be improved to ensure the safety of the existing captive population of finless porpoises. This means the elimination of all fishing with harmful methods (e.g. electricity, explosives, rolling hooks, gillnets, etc.) inside the reserve. It also means that the barrier to prevent the animals' escape into the Yangtze River during the flood season must be completed.
2. A critical review and summary of knowledge is needed which synthesizes all information available, published and unpublished, concerning the reproduction, social behavior, and husbandary requirements of finless porpoises. This review also needs to integrate genetic and demographic factors and to provide advice on the required size and composition of a founding stock, integrating as much information as possible on the behavior and social structure of finless porpoises (see previous Recommendation No. 4, under *in situ*).
3. Rigorous evaluation of water quality and sediment in the Reserve must be completed, including measurement of fecal coliform levels during the dry season when flushing is at a minimum. Organochlorine, organotin, and heavy metal levels inside the Reserve should be compared with levels in the Yangtze mainstem. Contaminant levels should be measured in at least one

of the porpoise's prey species inside the Reserve. Some of the environmental evaluations need to be done only once, but some aspects of water quality and sediment conditions will need to be monitored on an ongoing basis.

4. The five animals inside the Reserve should be marked to facilitate long-term management and research. Freeze-branding is probably the best method available, and it should be done in collaboration with someone who already has experience with the technique (e.g. R. Wells).
5. A behavioral conditioning regime should be established with the five finless porpoises so that they can be handled and examined routinely. Among other things, their blood chemistry and hematology can then be compared with those of captive and wild porpoises (e.g. see Sweeney *et al.* 1995; Wells *et al.* 1995; Hansen *et al.* 1995, for bottlenose dolphins).

Conservation of finless porpoises in captivity (*ex situ*):
The two porpoises currently in captivity at the Institute of Hydrobiology present opportunities for certain kinds of research that could benefit future captive breeding efforts. Among the actions that should be completed with these animals are:

1. Establish collaborations with people at Japanese and Hong Kong aquaria to develop procedures for training, ultrasound examinations, blood profiling, tissue collection and preservation for use with new or future reproductive technologies, etc.
2. Some experimentation with tools to be used for research on wild porpoises and on porpoises in the semi-natural reserve would be of great benefit. For example, these animals could be used to test techniques for age estimation, to test harnesses to be used for radio-tag attachment, or to refine and evaluate freeze-branding techniques. At present, however, given the very poor water quality in the tanks, such experimentation is probably too dangerous. The value of the animals in tanks would be enhanced if the water quality were improved.
3. Conduct food-preference trials to learn something about porpoise feeding habits.
4. A focused study of female and male reproduction, based on the monitoring of hormone levels and behavior of the captive animals, would be worth continuing and publishing.

It is hoped that the recommendations outlined here will be useful to researchers and conservationists both within and outside China. With this "blueprint" to guide decisions about how funds should be invested, as well as a renewed commitment to the conservation of China's wildlife, it may be possible to prevent the finless porpoise from following the tragic path of the baiji.

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Appendix 1: Workshop Agenda

Developing a Conservation Action Plan for the Yangtze River Finless Porpoise Population

Day 1 (Tuesday, 16 September)

10.00 Welcomes and introductions

10.30 Presentation – Wang Ding
Recent work on Yangtze finless porpoises by Wuhan Institute of Hydrobiology

11.00 Presentation – Zhou Kaiya
Recent work on Yangtze finless porpoises by Nanjing Normal University

11.30 Questions and Discussion

11.50 Break for lunch

14.00 Group Discussion – Background on Yangtze Finless Porpoises
1. What is known about Yangtze finless porpoise life history (reproduction, feeding, etc.)?
2. Is there more than one Yangtze finless porpoise stock?
3. What are the main threats to the Yangtze finless porpoise population?
4. Is the finless porpoise less vulnerable to bycatch than the baiji?
5. Is there evidence that the Yangtze River mainstem can no longer support finless porpoises?
6. How can we determine if there is competition between finless porpoises and baiji?

18.00 Break for dinner

Day 2 (Wednesday, 17 September)

09.00 Group Discussion – The Potential Role of Semi-Natural Reserves
1. Is the Shishou Reserve currently a safer place for individual porpoises (than the mainstem)? What about the Tongling Reserve?
2. Should the Shishou Reserve be a single-species reserve? If so, for which species?
3. Should finless porpoises be placed in the reserve at Tongling?
4. If live-captures are required, what techniques should be used?
5. Should captive breeding and artificial insemination play a role?
6. Should public viewing and "ecotourism" be allowed or encouraged at the reserve(s)?

13.00 Break for lunch

14.00 Group Discussion – Protection in the Natural Habitat
1. What techniques should be used for population assessment and stock structure studies?2) Can we define and designate critical habitat for finless porpoises in the Yangtze?3) Should additional radio-tracking be undertaken?
4. How can public awareness of the finless porpoise best be increased?
5. How can existing measures to protect baiji be modified to also benefit finless porpoises?
6. What realistic measures can be taken to protect finless porpoises in the Yangtze?

18.30 Break for dinner

Day 3 (Thursday, 18 September)

09.00 Group Discussion – Agreeing on Wording of Recommendations for action plan

11.45 Closing remarks

12.00 Break for lunch and boat trip to observe finless porpoises

17.00 Return to pier

Appendix 2: List of Participants

Invited Experts:
Thomas A. Jefferson, Ocean Park Conservation Foundation
Toshio Kasuya, Mie University
Randall R. Reeves, Okapi Wildlife Associates
Brian D. Smith, Aquatic Biodiversity Associates
Wang Ding, Wuhan Institute of Hydrobiology
Wang Peilie, Liaoning Marine Fisheries Research Institute
Randall S. Wells, Chicago Zoological Society
Bernd Würsig, Texas A&M University
Zhou Kaiya, Nanjing Normal University

Observers:
Lien-siang Chou, National Taiwan University
Mary Felley, Ecosystems, Ltd.
Reimi Kinoshita, Ocean Park Corporation
Mark Shea, Hyder Environmental Ltd.